

Study Review

Meeting the needs of US dietitians for food composition data

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Abstract

As the largest group of US food and nutrition experts, registered dietitians (RDs) require food composition data to make practice decisions. Uses for these data vary with the practice area, but RDs experience some common needs: (1) easy access to data, (2) continual updates with new foods and new food components important to human health, (3) simple ways to keep abreast of changes, and (4) a basic understanding of the uses and limitations of the data in various practice areas. These needs are largely being met, but gaps exist and some improvements can be made. Availability of accurate data has improved along with the technology to convert the information into useful formats for planning and evaluating diets, writing educational materials, counseling clients and conducting research. However, RDs in some settings may not have access to the technology needed to use food composition databases. Many undergraduate programs do not include courses or training about how food composition data are generated and tabulated. RDs may not know where to quickly find information or know what data are available. As food composition data continue to expand and technology advances, RDs may benefit from exploring new ways to stay abreast of changes and advocate for what is most needed in their practices. Better methods and more food composition data will support evidence-based and cost-effective dietetic practice.

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1. Introduction

US registered dietitians (RDs) serve the public by promoting optimal nutrition, health, and well-being throughout the lifecycle and in a myriad of practice settings (ADA, 2007). To fulfill their roles as food and nutrition experts, RDs rely on the availability of sound food composition data to conduct research, develop and apply evidence-based nutrition guidelines, and monitor the intake of individuals and groups. Little has been written about the specific food composition data needs of US RDs. Although uses for food composition data vary with the practice setting, RDs experience some common needs based on their overarching role as the food and nutrition expert: (1) easy access to food composition data;

(2) databases that are continually updated with new foods and food components important to human health; (3) simple ways to keep abreast of changes in food composition data; and (4) an understanding of the uses and limitations of food composition data in their practice setting. This paper examines how well these needs for food composition data are being met.

2. Ease of data access improving

Since the early days of food analysis in the late 1880s, the composition of foods has been disseminated in print form (USDA, 1896, 1950; Pennington and Douglass, 2005). With the passage of the Nutrition Labeling and Education Act of 1990 (FDA, 1999), printed data for a list of government-mandated nutrients are easily accessible on the labels of most US foods. Although printed data are useful for making inquiries about the composition of foods, manually summarizing the composition of multiple components in specific foods over a day or several days is

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laborious and impractical. Various “short methods” of calculating the composition of diets were developed using the average value of key nutrients among groups of foods (Clark and Cofer 1962; Leichsenring and Donelson, 1951; Wheeler et al., 1996). With the advent and continual improvement of computers and nutrition software since the late 1950s and the development and expansion of the World Wide Web (WWW) and wireless technology since the 1990s, RDs can now access, compute, and evaluate the food composition of client intakes, meal plans, or food frequency questionnaire responses (McNutt et al., this issue) faster and more easily than ever before and from locations other than the office desktop (Bodner-Montville et al., 2006; Cekola and Litov, 2006; Champagne and Allen, 2004; Hart and Kolasa, 1985; Hertzler and Hoover, 1977; McCaffree, 2001; Neighbors-Demberekyj and Painter, 2002; Orta and Reinarts, 1994; Probst and Tapsell, 2005; Stumbo, 2007). RDs have seen the development of applications tailored for specific practice areas such as school nutrition, institutional and restaurant foodservice, food labeling, counseling, education, and clinical and epidemiological research. Table 1 lists some examples.

As technologies improved and costs decreased, food composition applications and the associated hardware have become more accessible to RDs and also to their clients (Connors, 2006; Aronson, 2007). Via the WWW, RDs and their clients can search US food composition databases, use web-based software to calculate daily intakes (Neighbors-Demberekyj and Painter, 2002), view nutrition labeling data via food manufacturer or grocery websites (e.g. Peapod[®], 2007), obtain the composition of menu items or entire meals at some chain restaurants (e.g. Arby's[®], 2007), and interact with clients in real-time (Aronson, 2007). Table 2 presents a few examples to illustrate these developments.

Despite the variety of dietary assessment applications currently on the market, not everyone has access to or uses the available technology to access food composition data (Connors and Simpson, 2004; Fox et al., 2001; Hoggie et al., 2006; Turner, et al., 2005). Although use of technology is not widespread, especially in healthcare (Aronson, 2007; Hoggie et al., 2006; McCaffree, 2001), it is on the increase. For example, data for the 1999–2000 school year showed 46% of school districts used computerized nutrient analysis

Table 1
Examples of specialized food composition applications^a

Title	URL
<i>Clinical and epidemiology research</i>	
Food and Nutrition Data System for Research (NDSR), University of Minnesota Nutrition Coordinating Center, Minneapolis, MN	http://www.ncc.umn.edu
Food Intake Analysis System (FIAS), UT-Houston Health Science Center, Houston, TX	http://www.sph.uth.tmc.edu/fias
NutritionQuest, Berkeley, CA	http://www.nutritionquest.com
ProNutra, Viocare Technologies Inc., Princeton, NJ	http://www.viocare.com
<i>School foodservice</i>	
USDA Nutrient Standard Menu Planning Approved Programs	http://healthymeals.nal.usda.gov (select Nutrient Standard Menu Planning)
Snackwise [®] Nutrition Rating System, Columbus Children's Hospital, Columbus, OH	http://www.snackwise.org
<i>Institutional foodservice</i>	
The CBORD Group Inc., Ithaca, NY	http://www.cbord.com
Computrition Inc., Chatsworth, CA	http://www.computrition.com
CookerPro [®] Recipe Software, Barrington Software Inc., Barrington, IL	http://www.cooker.com
Culinary Software Services Inc., Boulder, CO	http://www.culinarysoftware.com
DietMaster Systems Inc., Rochester, MN	http://www.dietmaster.com
MenuMizar, Menu Systems Inc., Ruffs Dale, PA	http://www.menumizar.com
CalcMenu Web, Redwood City, CA	http://www.eg-software.com
Menu2U [®] Plus, HPSI Inc., Irvine, CA	https://www.webmenuplus.com
<i>Food labeling</i>	
Genesis R&D ESHA Research, Salem, OR.	http://www.esha.com/genesissql
NutriData, San Clemente, CA	http://www.nutridata.com
Nutritionist Pro [™] Food Labeling Software, Axxya Systems, Stafford, TX	http://www.nutritionistpro.com/np_core_food
TechWizard [™] , Owl Software, Columbia, MO	http://www.owlsoft.com
<i>Teaching</i>	
Diet Analysis Plus, Thomson Wadsworth, Florence, KY	http://thomsonedu.com/nutrition (select nutrition software)
DINE [®] Healthy Curriculum Guide, DINE Systems Inc., Whiteville, NC	http://www.dinesystems.com
EatRight Analysis, ESHA Research	http://nutrition.jbpub.com/resources/software.cfm
Nutrition and Exercise Manager Software, CalorieKing, Costa Mesa, CA	http://content.calorieking.com/solutions/educational
Nutritionist Pro: Nutrition Analysis Software, Axxya Systems	http://nutrition.jbpub.com/resources/software.cfm
You are what you eat, The Nutrition Company, Long Valley, NJ	http://www.nutritionco.com/YAWYE.htm

^aThis is not a comprehensive list; inclusion does not constitute an endorsement by the authors. Websites accessed on June 15, 2007.

Table 2
Examples^a of web-based food composition applications

Name and URL	Description
<i>General applications</i>	
DietSite.com Inc. http://www.dietsite.com	Free diet and exercise analysis tool
Fast Food Nutrition Facts Explorer http://www.fatcalories.com	Search and compare nutrient data for foods at 12 popular chain restaurants
FitDay™, Cyser Software Inc. http://www.fitday.com/	Track food, exercise, weight loss and goals with this free diet journal
Foodcount®.com Inc., Flagstaff, AZ http://www.foodcount.com	Free and fee-based versions of this diet analysis tool
Healthy Dining, San Diego, CA http://www.healthydiningfinder.com	Find healthy menu items at participating restaurants near your home
Lifeclic® Health management Systems, Burtonsville, MD http://www.lifeclic.com	Food and exercise diary; track your other health information
MyPyramid Tracker http://www.MyPyramidTracker.gov	USDA online dietary and physical activity assessment tool; free
Nutrition Analysis Tools and System (NATS) http://nat.crgq.com/index2.html	Compare intake to recommendations; get lists of foods high/low in specific nutrients; free
Wellness Layers Inc., East Rockaway, NY http://www.dietwatch.com	Fee-based diet, exercise, motivation, and community support for health and fitness
<i>Applications for counseling</i>	
CalorieKing®, Costa Mesa, CA http://content.calorieking.com/solutions/ckcomplete	Web-Based diet and nutrition program
DietHistory.com http://www.diethistory.com	Online food intake questionnaire gives immediate feedback to subjects and researchers
DietMaster Web, Lifestyles Technologies Inc., Valencia, CA http://lifestyletech.com/page13.html	Internet version of DietMaster Pro; logged food and exercise data can be shared between client/patient and counselor
DietMatePro®, PICS Inc., Reston, VA 20191 http://www.DietMatePro.com	Uses Web and Palm-based technologies to monitor intake of clients/subjects
EshaTrak, ESHA Research, Salem, OR http://www.esha.com/eshadata/eshatrak	Tracks client dietary intake and exercises, calculate analysis and generate a variety of nutrition reports
Wellness, PureWellness, Burlington, VT http://www.purewellness.com	Online health and wellness applications for corporations, benefit providers and fitness centers
My ProConnectSM, Pronex Inc., Deer Park, IL http://www.myproconnect.com	Web-based integrated application connecting client with nutrition professionals
Nutrihand™ Pro, Nutrihand Inc., Mountain View, CA http://www.nutrihand.com/myNutrihandMP.html	Health professionals analyze client's meals, fitness and medical data
VioScreen, Viocare Technologies Inc., Princeton, NJ http://www.viocare.com/products/vioscreen.aspx	Clients complete a web-based dietary health questionnaire and results are immediately available to dietitian for counseling

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to develop menus for their lunch programs, up from 33% in 1997–1998 (Abraham et al., 2002). Even when computer technology is available, however, RDs may not be using them for dietetic purposes. Among US entrepreneurial RDs, a 1999 study indicated they use the computer primarily for word processing and financial record keeping and less often for dietary counseling and assessment (Johnson et al., 1999). In 2005, only a few of the 25% of Oklahoma RDs with personal digital assistants (PDAs) were using them for dietetic purposes (Turner et al., 2005). Among those who currently use food composition software, however, new needs have emerged such as integrating multiple applications (i.e., interoperability), improving usability, and adapting the technology to meet changing departmental goals (Grossbauer, 2007).

It is unclear why some RDs are not using the available technology to access food composition data. Concerns

expressed by entrepreneurial RDs included fear of losing data, the time to enter information reduces time available to interact with client, and software is too expensive and difficult to use (Johnson et al., 1999). One nutrition consultant (Aronson, 2007) suggests that RDs have been slow to adopt online counseling software for reasons such as resistance to changing their counseling paradigm, comfort with their current system, fear of the unknown or failure, and not having a clear understanding of the risks and benefits. A 1985 survey of institutional foodservice directors found two barriers to instituting computerized food composition software: (1) a belief that their department was too small for computerization and (2) limited knowledge of computers and food composition analysis. The influence of department size was also seen in the school foodservice sector with districts using computerized nutrient-based menu planning in 1999–2000 tending to be

large in size or operated by management companies. The most difficult tasks these districts encountered when computerizing included entering and calculating recipes, entering and evaluating menus, and obtaining missing nutrient information but these tasks posed less of a burden once the system was in place (Abraham et al., 2002).

3. Accurate and up-to-date information generally available

With advances in analytical methodology, development of standard reference materials for analytical quality control (Phillips et al., 2006; Sharpless et al., 2004), and the use of sound sampling procedures and statistical analysis (Haytowitz et al., 2002; Holden et al., 2002; Pehrsson et al., 2000), US food composition data are more accurate than ever before. Confidence in the accuracy of US databases has been affirmed by studies that show generally good agreement between database values and analytical data for diets or individual menu items. Calculations from four food composition databases were compared with chemical composition from the Dietary Approaches to Stop Hypertension trial and differences between the databases and the chemical analyses for 12 nutrients were less than 15% (McCullough et al., 1999). Good accuracy was also found between fat and energy values from restaurant chain information and chemical analysis of purchased samples (Root et al., 2004). General agreement, but with some discrepancies by location, were found when the fat content of purchased restaurant meals were measured by direct analysis and compared to menu values (Sloan and Bell, 1999). A slightly larger variation (–21 to +22%) was found between analysis and calculations of metabolic diets containing vitamin K levels typical of a free-living population (McKeown et al., 2000).

Through ongoing funding and special programs, the US strives to provide food composition databases that provide accurate and representative data for food components important for public health and research (Ershow, 2003) and in units consistent with the Dietary Reference Intakes (Gebhardt and Holden, 2006; Otten et al., 2006). Despite a wealth of new information, however, data for some food components such as tyramine, biotin, and vitamin K are still limited (Dismore et al., 2003; McCabe-Sellers et al., 2006; Staggs et al., 2004) and discussions about how to track and measure unique components in functional foods (e.g. biologically active probiotics and prebiotics) is beginning (Spence, 2006). In addition to a lack of data for some food components, RDs using food composition software may find that some foods or ingredients important to their practice are not included in the database. For example, entries for institutional foodservice products, commercial ingredients (Cunningham et al., 2004), and nutritional supplements (Dwyer et al., this issue) are not found in most food composition databases. Many applications, however, allow the user to manually enter data for new foods in the database when that information is available.

Finite resources and the continual emergence of new foods and interest in new bioactive components means a gap will always exist between what RDs need and what is available. RDs and their professional organizations can identify priorities for data generation and advocate for the public policies and funding needed. As dietetic practice shifts from promoting adequate nutrition to an emphasis on disease prevention, the need for more specific data on more food components and a greater variety of foods will increase, especially as nutrition counseling begins to consider genetic profiles (Debusk et al., 2005). With increasing availability of functional foods, herbal remedies, dietary supplements, prescription and over-the-counter medications, clinicians may also need data about food–herb–drug interactions and ways to prevent them (McCabe, 2004).

4. Keeping abreast of changes is challenging

A realistic and practical question for the busy nutrition professional is how to keep up with data for the profusion of new foods, exotic foods, modifications to current foods, and new bioactive food components as well as the associated hardware, software and web-based applications. Although a wealth of information on food composition exists, RDs may not know where to quickly find information and what data are currently available (Johnson et al., 1999), especially because there is no one clearinghouse for all food composition information. Some practical suggestions are to search the WWW and Pubmed for information, query colleagues via listservs, and contact food composition experts. Some sources for food composition information are shown in Table 3. The National Nutrient Databank Conference, a non-profit group dedicated to fostering communication among food composition database generators and users, convenes an annual meeting with published proceedings, and periodically prepares an International Nutrient Databank Directory (Braithwaite et al., 2006). As nutrition informatics emerges as a specialty within the ADA (Hoggie et al., 2006; Scollard, 2006), additional ways to assist RDs in keeping abreast of food composition data and their applications may develop.

5. Uses and limitations of data must be understood

All RDs need a basic understanding of how food composition data are generated, the level of precision needed for a given practice area (Pennington, this issue), how to appropriately apply food data when planning or assessing the intake of individuals and groups (Barr et al., 2002; Murphy, 2003; Murphy et al., 2006; Stumbo and Murphy, 2004), and knowledge about basic features of food composition applications. With the increasing variety of databases and software available, RDs must reconcile advantages and disadvantages among different programs or databases (Hoover, 1983; Lee et al., 1995; Snetselaar et al., 1995) and guide clients as well as themselves in

Table 3
Resources^a for food composition data and associated applications

Title	Description	URL
<i>Government food composition data</i>		
Child Nutrition Database; USDA	Database for USDA approved software programs in schools using Nutrient Standard Menu Planning	http://healthymeals.nal.usda.gov (select Nutrient Standard Menu Planning)
Food and Nutrient Database for Dietary Studies (FNDDS) and Search Tool; USDA	Nutrient profiles for foods commonly eaten in the US; used in <i>What We Eat in America</i> , NHANES	http://www.ars.usda.gov/ba/bhnrc/fsrg
National Nutrient Database for Standard Reference (SR); USDA	Foundation for most US databases; used in food policy, research and nutrition monitoring	www.ars.usda.gov/nutrientdata
Nutrient Data Laboratory, USDA	Special interest databases	http://www.ars.usda.gov/Services/docs.htm?docid=5121
	Common terms	http://www.ars.usda.gov/Services/docs.htm?docid=10154
	Frequently asked questions	http://www.ars.usda.gov/Main/docs.htm?docid=6233
	US and international food composition links	http://www.ars.usda.gov/Aboutus/docs.htm?docid=6300
	Journal articles	http://www.ars.usda.gov/Aboutus/docs.htm?docid=6253
<i>Journals</i>		
Journal of Food Composition and Analysis	Peer-reviewed journal for the composition of human foods	http://www.sciencedirect.com/science/journal/08891575
Journal of the American Dietetic Association	Peer-reviewed journal; includes food composition information	http://www.adajournal.org
<i>Email or web publications</i>		
Daily News	Email update on food and nutrition topics for American Dietetic Association members	http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/home_547_ENU_HTML.htm?dologin=1
Food and Nutrition Research Briefs	Quarterly publication highlighting USDA food and nutrition research	http://www.ars.usda.gov/is/np/fnrb
International Nutrient Databank Directory	Comparison of of selected food composition databases	http://www.healthcare.uiowa.edu/gcrc/nndc
<i>Conferences</i>		
National Nutrient Databank Conference	Annual meeting on food composition issues	http://www.nal.usda.gov/fnic/foodcomp/conf
<i>Compilations and reviews^b</i>		
Hardware and nutrition software for PDAs	Compiled by pdaRD.com	http://www.pdard.com
Computer software: resources and references	Compiled by American Dietetic Association	http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/nutrition_5378_ENU_HTML.htm
Nutrition Software Reviews 2007	Ratings of commercial nutrition software	http://nutrition-software-review.toptenreviews.com
Links to diet software web sites	Compiled by Cybersoft, inc., Phoenix, AZ	http://www.dietsoftware.org/links.shtml

^aThis is not a comprehensive list of resources; inclusion does not constitute an endorsement by the authors. All websites were accessed on June 27, 2007.

^bFor additional food composition software applications, see Table 1 and Probst and Tapsell, 2005; Stumbo, 2007.

selecting and using software (Connors, 2006). Although a variety of articles have described considerations for selecting food composition software and databases (Anonymous, 2000; Buzzard et al., 1991; Frank and Pelican, 1986; Hoover and Pelican, 1984; Probst and Tapsell, 2005; Stumbo, this issue; Vozenilek, 1999), RDs may still be uncomfortable making purchasing decisions (Johnson et al., 1999).

One question is how to best educate dietetic students. Dietetic graduates should be able to calculate and interpret the composition of foods (Commission on Accreditation for Dietetics Education, 2002); however, undergraduate curricula and internship programs may not be fully preparing students to use existing data and emerging

technology because most dietetic training programs include few courses and little training in food composition data. Training will need to include use of the associated technology as well. Turner et al. (2005) suggests using PDAs in dietetics programs so students would be more likely to use them in their practices. Dietetic students who were surveyed about using a handheld computer for nutrition assessment felt confident they could learn to use the technology despite having some anxiety about destroying information or making uncorrectable mistakes (Molaison and Connell, 2005). Perhaps new teaching resources for the area of food composition and technology may be needed to equip instructors and educate students.

Another question is how to provide continuing education for practitioners so they can gain more specialized knowledge about food composition and technology and respond to emerging opportunities (Almanza et al., 1997; Burton et al., 2006). Special skills might include calculating composition of restaurant menu items, adding foods in a standardized fashion to a database, or imputing values when analytical data are unavailable (Schakel et al., 1988). With the increasing use of technology to disseminate food composition data, RDs may also need some level of understanding or proficiency in this area. Examples of novel applications include interactive websites and touch-screen kiosks at university cafeterias so students can determine the composition of menu items or meals and compare with health guidelines (FM Staff, August 2006); downloadable audio and video podcasts about menus and nutrition information (FM Staff, August 2006); hospital intranet systems providing food composition information for cafeteria items (Higgins, 2004); smart card technology to monitor eating habits of children at a school cafeteria (Lambert et al., 2005); interactive multimedia and bilingual dietary assessment programs (Baranowski et al., 2002; Zoellner et al., 2005); automated multiple pass 24-h recall methodology (Raper et al., 2004); and camera phones for documenting food consumption (Wang et al., 2006; NutraxTM, 2007). Ways to satisfy the need for additional training might include a new special interest or practice group, seminars and online classes, periodicals, more inclusion in ADA Position papers, or a list of competencies for RDs who specialize in this area.

Another question to consider when educating RDs and students is the degree of accuracy required for the situation (Clark and Cofer, 1962). Providing data in an electronic format is not a guarantee of accuracy (Hogge et al., 2006), even the commonly used food exchange lists have limitations that need to be considered in dietetic practice (Wheeler, 2003). Although RDs could use food composition software to calculate a client's intake of multiple components over many days or plan institutional menus, it is unclear whether this is cost-effective or whether "short methods," paper-based screening questionnaires, food-based menu planning, and clinical judgment are adequate in some practice settings. For example, a 1999–2001 study of Texas schools showed that meals developed using either food- or nutrient-based methods met guidelines for energy, protein, calcium, iron, and vitamins A and C, but only the meals developed using computerized nutrient-based planning met the fat and saturated fat goals (Connors and Simpson, 2004). Although an "enhanced" food-based menu planning method, which included more grains, fruits, and vegetables, did increase the fiber content of meals compared to the traditional food-based meal planning, the "enhanced" meals still exceeded fat and saturated fat goals (Connors and Simpson, 2004). In clinical practice, the food exchange system is commonly used by RDs for meal planning and education even though the mean nutrient value for a food group may vary widely from the nutrient

values for individual foods within that group (Wheeler, 2003). With escalating healthcare costs, the move to evidence-based practice and the ADA Nutrition Care Process and Model (Lacey and Pritchett, 2003), RDs will need adequate evidence-based information to determine the most cost-effective ways to use and apply food composition data to provide quality nutrition services. As hospitals move towards electronic health records (Biese-meier and Chima, 1997), dietetic and nutrition departments will have opportunities to consider how food composition technology might integrate with the electronic health records and provide RDs with data needed in clinical decision making.

6. Are RDs' needs for data being met?

Food composition databases are important tools for improving national health. Both availability and accessibility of data have improved along with the technology to convert the information into useful formats for planning and evaluating diets, writing educational materials, counseling clients, preparing nutrition labels and conducting research. Improved features of food composition databases work synergistically with improved dietary assessment software to enhance the dietitian's ability to evaluate diets at both the individual and group levels. As opportunities arise for use of food composition data especially from computerized applications for healthcare, foodservice and counseling, RDs must improve their skills in this specialized practice area. RDs may benefit from exploring new ways to stay abreast of changes and to advocate for what is most needed in their practices. Perhaps a new ADA special interest or practice group and a list of competencies for RDs who specialize in this area are needed. As the food and nutrition experts, all practitioners will gain from becoming more knowledgeable about the burgeoning information about today's food supply. RDs can play an important role in ensuring that food composition databases are used appropriately by consumers who seek better nutrition information and by health professionals in their practice.

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